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ORIGINAL PAPER

Promoting downstream processing: resource nationalism or industrial policy?

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Abstract
The article aims to provide a critical overview of the arguments used in the debate about policies to promote downstream processing of minerals, particularly coercive policies such as export taxes or bans. It reviews some of the possible reasons why downstream processing of minerals does not always take place in the country where they are mined, including asymmetry of market power, tariff escalation, scale factors, availability of inputs, closeness to market, and business environment. The costs (in terms of lost exports of unprocessed exports) and benefits (in terms of increased processing) of coercive further processing policies are discussed, using as an example Indonesia's ban on exports of unprocessed minerals from 2014 to 2016. It is concluded that there are few if any examples of successful use of taxes or restrictions on unprocessed products to promote downstream processing. Existing evidence appears to show that the severity and duration of the downturn in exports of unprocessed products surprised governments and that few governments even attempt to estimate either the negative or the positive impacts in any systematic manner. It would probably be more productive in most cases to instead emphasize industrial policies that focus on removing constraints and bottlenecks that stand in the way of the economy reaching its full potential, including those relating to skills, credit, energy supply, transport infrastructure, and inappropriate regulation.

Keywords Downstream processing · Export constraints · Export taxes · Industrial policy · Mineral processing · Mining · Resource nationalism

Why is it important to think about downstream processing now?

The economic policy debate about downstream processing has a long history, usually colored in mercantilist or central planning hues, with the most prominent examples being found in the old Soviet Union. It would have been easy to believe that this discussion had been laid to rest with the dissolution of the Soviet Union and the discredit of central planning and with the disappointing results of industrial policy as pursued in the 1970s and 1980s, not just in developing but also in developed countries. For anybody who doubted, recent history could have been expected to provide sufficient empirical evidence for even the most skeptical. For the past 30 years, world trade has grown faster than ever, resulting in a dramatic reduction in poverty, in large part due to specialization and the fragmentation of supply chains, as demonstrated by the fact that world trade has grown much faster than world GDP, contradicting the arguments of those who believe in the benefits of policies aimed to promote vertical integration within one country.

However, more recent thinking about industrial policy advocates a more nuanced approach, focusing on the role of transaction costs and in particular on the institutions that reduce transaction costs. As expressed by Dietsche (2017, p. 5):

> The general case for industrial policy is built on the argument that there are situations in which markets rely on the public sector to achieve broadly desirable economic and social outcomes. These situations are, but are not limited to, those cases where clear 'market failures' can be identified. Therefore, industrial policy sits at the heart of the relationship between markets and states, and it also shapes economies and the social outcomes they produce.

It could be argued that government efforts to reduce transaction costs could result in improved conditions for

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downstream processing. Such efforts could be seen as elements of industrial policy, which, after all, comes in a large variety of flavours (see Smart 2017).

Several governments seem to think that vertical integration will yield better results in terms of resource-based development than earlier approaches:

> Achieving the transformative potential of Africa's resources requires a new way of thinking about minerals, which aligns with the continent's own priorities of industrialisation and diversification through value-addition, processing, beneficiation and the creation of strong mineral-led linkages with other sectors of our economies (Fatima Haram Acyl, African Union Trade and Industry Commissioner, Indaba 2017).

Policies in a growing number of countries confirm the interest in downstream processing. Some countries have used positive fiscal incentives. Indonesia, for instance, relies on tax holidays, reductions in corporate income tax and duty exempt imports to incentivize primary mineral producers to invest in processing facilities (Bellefleur 2014). Rwanda applies a 15% Preferential Corporate Income tax for projects exporting processed minerals up to 50% of turnover of minerals produced in Rwanda (Rwanda Development Board n.d.). Generally, businesses in Rwanda pay tax at the rate of 30%. Other countries, including India (iron ore) and Zambia (copper), have introduced export taxes on unprocessed commodities. Finally, some countries have resorted to outright bans on the export of unprocessed commodities, including Indonesia on bauxite, copper, nickel and tin from 2014 to the end of 2016 and Tanzania on copper and gold since March 2017 (Östensson and Löf 2017).

All of these developments justify a closer look at policies aiming to support or promote downstream processing of minerals, particularly through restrictions on exports, and to try to assess the possibilities of success of these policies. These possibilities may depend partly on the degree to which the policies form part of a coherent industrial policy framework or whether they represent attempts by populist politicians to mobilize the electorate or reward particular constituencies under the heading of "resource nationalism."

The term resource nationalism does not have an agreed definition. Its meaning may range from a broad and uncontroversial "desire of the people of resource-rich countries to derive more economic benefit from their natural resources and the resolution of their governments to concomitantly exercise greater control over the country's natural resource sectors" (Southern African Institute of Mining and Metallurgy 2012), to a narrower "anti-competitive behaviour designed to restrict the international supply of a natural resource" (HM Government Horizon Scanning Programme 2014).

At this point, it is worthwhile recalling that actions to promote downstream processing through restrictions on exports may be incompatible with countries' commitments under WTO rules.[1] Most export taxes or bans are not challenged in the WTO because no other country than the one imposing the measures suffers any significant damage. However, in many cases, taxes can also be challenged under bilateral trade deals or investment treaties, for instance, the EU Economic Partnership Agreements. Thus, Article 15 of the Interim Agreement establishing a framework for an Economic Partnership Agreement between the Eastern and Southern Africa States, on the one part, and the European Community and its Member States, on the other part, reads "Except as otherwise provided in Annex III and for the duration of this Agreement, the Parties shall not institute any new duties or taxes on or in connection with the exportation of goods to the other Party in excess of those imposed on like products destined for internal sale" (European Union 2012).

The surrounding rhetoric sometimes sounds like resource nationalism aimed at domestic audiences and the objectives and underlying analysis are not always clear and explicit. However, one can imagine several mainstream arguments for making further processing an industrial policy objective:

- Prices of more processed products may be more stable and further processing would therefore provide some insurance against revenue variations;
- Processing raw materials may give rise to important learning effects and improve skills;
- The processed products may be strategic or, at least, less expensive, inputs for domestic manufacturing, construction, or agriculture.

The present article aims to provide a critical overview of the arguments used in the debate about policies to promote downstream processing of minerals, particularly coercive policies such as export taxes or bans. The "Market failure, policy failure or comparative advantage?" section in the following reviews some of the reasons why downstream processing of minerals does not always take place in the country where they are mined. The "Costs and benefits of downstream processing policies" section discusses costs and benefits of coercive policies, drawing partly on the example of Indonesia's ban on exports of unprocessed minerals from 2014 to 2016. The

[1] For instance, in 2009, export duties on bauxite, coke, fluorspar, magnesium, manganese, silicon metal, yellow phosphorus, and zinc, and export restrictions on some of them, imposed by China were challenged by the EU and the USA, later joined by Mexico. China argued in its defense that some of its export duties and quotas were justified because they related to the conservation of exhaustible natural resources for some of the raw materials (Article XX(g) of GATT 1994). But China was not able to demonstrate that it imposed these restrictions in conjunction with restrictions on domestic production or consumption of the raw materials. A dispute panel found for the complainants and in January 2013 China notified that it had abolished the duties (World Trade Organization n.d.-a).

"Conclusions" section, finally, attempts to draw some very general conclusions.

Market failure, policy failure, or comparative advantage?

Underlying much of the rhetoric surrounding the downstream processing debate is the idea that downstream processing should happen by itself and that its absence reflects one or more market or policy failures. In the case of minerals, downstream processing from the ore or concentrate stage usually involves weight reduction—by two-thirds for copper and by three-quarters for bauxite/aluminum, less for most other minerals—so lower freight costs should in principle be a powerful incentive for further processing. The fact that it still does not happen in many cases is interpreted by some to mean that the playing field is not level. It is important to note that, unlike the situation for manufactured products, branding, market segmentation, links to services or quality differences all play a minimal role in minerals and metals markets. Accordingly, the features most commonly underlying market failures are absent. It is almost never a question of processed products from mining countries not being competitive on the world market but rather of how to achieve sufficient profitability of the downstream stages.

Therefore, the reasons why downstream integration is not a feasible or favorable strategy for many enterprises may have to do mainly with comparative advantage. The difference is crucial, because while market failures can be corrected, at least in theory, doing something about comparative advantage is more difficult and takes longer time.

The market failure explanation of the lack of downstream integration rests on an assumed asymmetry of market power, where later stages of the supply chain are able to impose prices and other conditions on the earlier stages.[2] However, in actual fact, processing margins are often thin and very variable, which in these cases implies that processors are price takers rather than monopsonists. Figures 1 and 2 illustrate the cases of copper and iron ore/rebars respectively.

Figure 1 shows that the TC (Treatment Charge, the smelter's fee for converting copper concentrate to blister copper) and the RC (Refining Charge, the fee for refining blister copper to copper cathodes) have generally been a small portion of the price for refined copper cathodes and, maybe more important, the sum of the fees has fluctuated widely, sometimes being close to zero. Figure 2 shows that the situation has been similar with respect to the relationship between iron ore and rebars (also called reinforcing rods, the most basic form of steel).

There are almost certainly exceptions where margins are not as thin, although none comes readily to mind, but they are likely to reflect transitory situations of uneven market power. If indeed there is a significant rent element in the processing margin, then in theory, this can be captured by a minimum export price regime. This however requires considerable flexibility and sophistication on the part of government. Alternatively, a large processing margin in individual cases may simply reflect transfer mispricing of the unprocessed product, in which case strengthened capacity to deal with mispricing is the answer, not increased processing capacity.

Tariff escalation is often put forward as an explanation for the limited extent of downstream processing of minerals. Table 1 shows ranges of import tariffs for a number of processed mineral products in important importing countries (China, European Union, India, Japan, USA). Bound tariffs on iron ore, copper ores, and concentrates and bauxite (aluminium ores and concentrates) are 0, except in India, where tariffs on all three are 2.5%. Tariff escalation may appear significant, particularly since bound tariffs constitute a high portion of the value added at some processing stages.

However, regional and bilateral trade agreements have reduced applied tariffs, often to zero. ACP (African, Caribbean and Pacific) countries have free access to EU markets; AGOA (the African Growth Opportunities Act) provides the same for African countries for the US market. Accordingly, trade negotiations rather than export restrictions would appear to be appropriate where tariff escalation is a problem.

There are a number of other reasons that affect comparative and competitive advantage and which may act as obstacles to downstream processing:

Scale factors Many industrial processes require large scale to be commercially viable. If the available production of raw minerals is not sufficiently large, downstream processing is not economically feasible. For instance, a copper smelter needs access to about 150,000 tons of copper concentrate or more per year to be commercially viable. New crude steel plants using blast furnaces generally have a capacity of at least 2 million tons per year. Electric arc furnaces can be much smaller, but require inputs in the form of scrap or Direct Reduced Iron (DRI) that have to be available in sufficient quantities. A new alumina plant is not economic unless it produces at least 1 million tons per year. Moreover, developing countries seldom have

[2] According to the Singer-Prebisch hypothesis, named after Hans Singer (1950) and Raúl Prebisch (1950), in a world system in which poorer nations specialize in primary products, such as raw minerals and agricultural products that are then shipped to industrialized nations that, in turn, make advanced products to be sold to poorer nations, the major benefits of international trade will go to the wealthy nations. The reason for this state of affairs is said to be that primary commodity markets are competitive and so reductions in costs are passed on to consumers in the form of lower prices. Producers of many manufactured products, it is argued, enjoy a better position because they have some market power. This allows them to share the benefits of falling costs between workers in the form of better salaries and shareholders in the form of greater dividends.

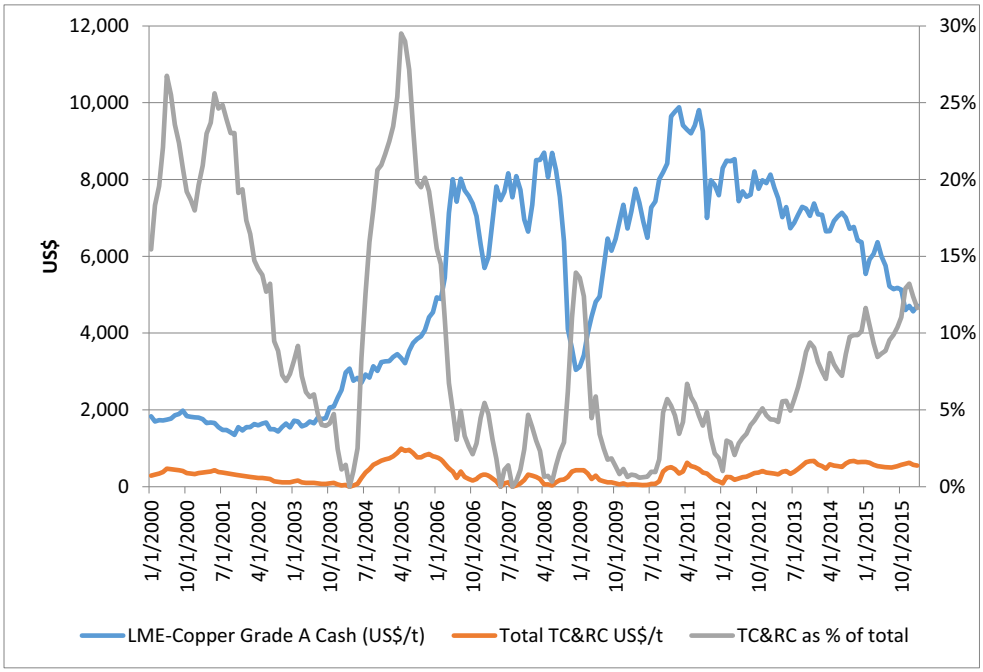

Fig. 1 LME copper price and TC and RC, 2000-February 2016, US$/tonne. Source: LME, quoted by Östensson and Löf 2017

domestic markets large enough to absorb a significant part of the mine output and thus provide a platform from which outward expansion can take place, and even if they did, production of the unprocessed mineral would often still be too large to be processed and used within the country—if Zambia had the same industry structure as South Korea and therefore, the same copper use per capita (at 15.6 kg the highest in the world in in 2012, according to the International Copper Study Group (2013)), measured at the stage of semi-manufactured products, it would still use less than 30% of its copper output.

Availability of inputs Important inputs have to be available at a competitive price. It is difficult for aluminum smelters to be competitive without low cost electricity. A legal requirement to process copper concentrate in the Democratic Republic of Congo was delayed after copper producers demonstrated that there was not enough electric power available to smelt and refine the copper mined in the country (Creamer Media 2016).

Closeness to market Small inventories and tight delivery margins have reinforced the importance of being able to deliver quickly. It takes 20 days at 13 knots from Durban to Guangzhou (Sea-distances.org n.d.): sometimes that is not fast enough for modern manufacturing. Moreover, delivering products with the right specifications on a timely basis to the manufacturing industry requires close contact with customers.

Business environment The overall business environment is obviously of importance. Mines have to be located where there are mineral deposits, but location choices for processing capacity can be made more freely. While the quality of a deposit may compensate for an unattractive (from the investor's point of view) investment regime, this is not

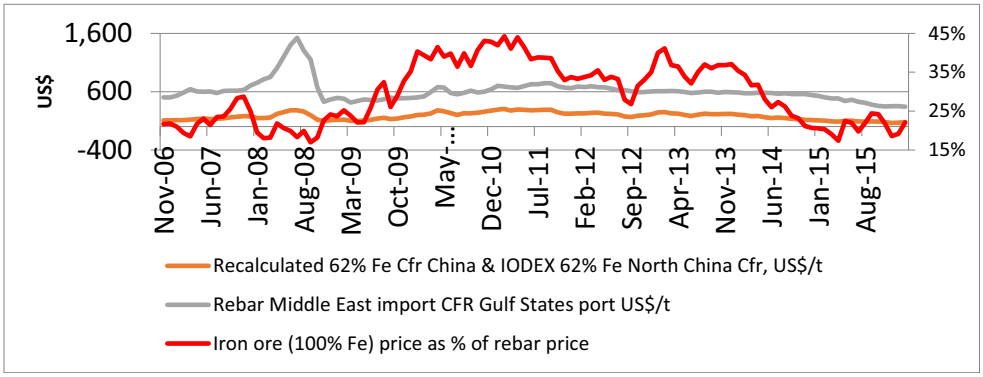

Fig. 2 Prices of iron ore and rebars, November 2006–February 2016, US$/tonne Fe. Source: Metal Bulletin, quoted by Östensson and Löf 2017

Table 1 Range of import tariffs, selected metals and countries, per cent

	Iron and steel (HS72)	Copper (HS74)	Aluminum (HS76)
China	1–10	0–15	0–10
India	5–10	5–10	2.5–7.5
European Union	0–2.2	0–5.2	0–8.8
Japan	0–2	0–3	0–7.5
USA	0	0–3	1.3–5.7

Source: World Trade Organization (https://www.wto.org/english/tratop_e/dispu_e/cases_e/ds433_e.htm)

the case for processing capacity. In addition to political risk considerations, factors such as availability of skilled labor, logistics, and financial services affect investment decisions. This factor is the one that, in principle, governments can influence most easily.

Costs and benefits of downstream processing policies

Policies intended to promote downstream processing of minerals have both costs and benefits. The objective is of course to devise policies such that the costs are more than offset by the benefits.

Costs

The most important cost of coercive downstream processing policies consists of missed production because production that otherwise would be viable and take place does not happen:

- Mineral deposits that are too small to justify investment in processing or too difficult to process domestically for mineralogical reasons remain undeveloped;
- Projects are not developed because of the additional risk associated with downstream processing;
- Mine production is constrained because of insufficient domestic processing capacity;

Figure 3 shows the development of unprocessed and processed mineral exports in Indonesia. An export ban on unprocessed minerals entered into force January 2014, combined with export taxes on certain minerals. The policy was primarily justified in nationalist terms and was described as a way of achieving "economic sovereignty." Without policies like the export ban, so the argument went, Indonesia would just continue selling cheap commodities to rich industrialized nations without ever moving up the global value chain (Inside Indonesia 2017).

The 2009 Mining Law laid the legal foundation for the 2014 export ban. Articles 102 and 103 of the law mandate that companies must add value to mineral ores prior to export. Article 170 stipulated that companies with contracts of work or mining licenses had 5 years from the law's enactment in

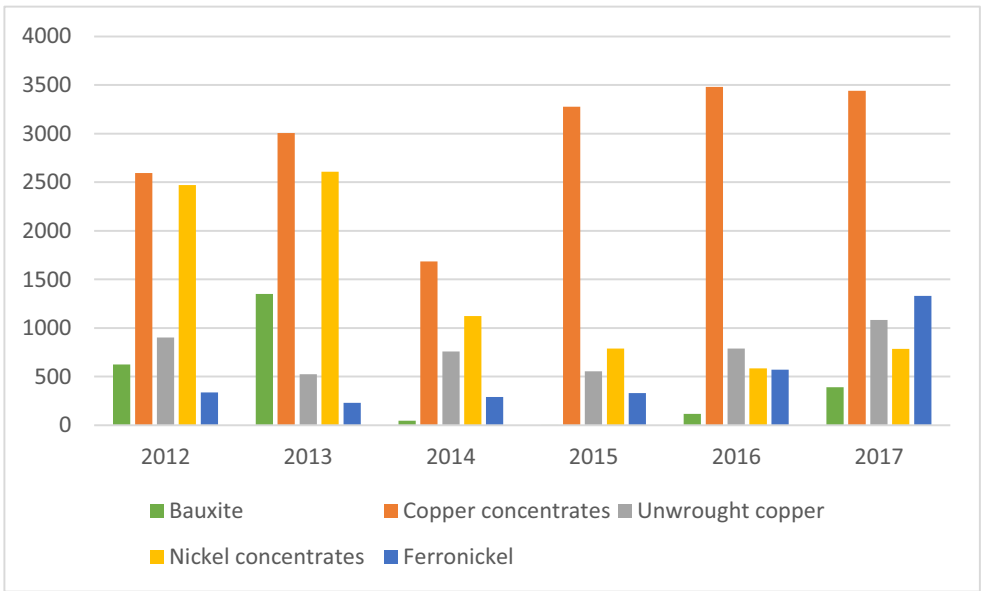

Fig. 3 Indonesian unprocessed and processed mineral exports, US$ million. Source: UNCTADStat n.d.; UN Comtrade n.d. (ferronickel)

which to prepare processing facilities. However, in the years following the law's enactment both foreign and domestic companies failed to invest in mineral smelters, not believing the government would introduce a hard ban and sacrifice export revenues. This meant that by 2014, Indonesia still had little refining or smelting capacity for key minerals like nickel, bauxite, or copper. Most mining companies assumed the government would re-think the intervention and retreat from the nationalist position.

The ban was followed by a severe downturn in mineral exports. This downturn was not offset by an increase in processed exports, partly because it took several years to build new processing facilities. In fact, two alumina refineries have been built. One was completed in June 2016 and produces metallurgical alumina, that is, alumina used in aluminum smelters (Aluminum Insider 2018). The other, which started production in 2015, produces chemical grade alumina (Reuters 2015). Both refineries export most of their production. However, their total bauxite use is about 5 million tonnes per year, whereas in 2013, the last year before the export ban entered into force, bauxite exports were 57 million tonnes. Nickel mines have changed their output in order to comply with the ban. They now export nickel pig iron (classified as ferronickel in trade statistics) instead of nickel concentrates. The upgrading is relatively simple and the price is only marginally higher. The total value of nickel exports in all forms was still considerably lower in 2017 than it was in 2013 (US$ 2116 million, compared to US$ 2839 million). Little has happened to copper production and exports since the largest producer, Freeport McMoRan Copper and Gold, was allowed to postpone any investment in processing capacity.

It is not surprising that efforts to promote the domestic processing of minerals through the use of export taxes or bans result in reduced exports of unprocessed minerals—that is, after all, the objective of the policy. The Indonesian example shows that the reduction in unprocessed exports can be large enough to have macroeconomic consequences and that the conversion to processed exports is at worst not possible and at best expensive and time consuming.

In order to achieve the objectives of downstream processing policies, it is not enough to impose export taxes or bans—producers usually have to be given positive incentives to invest in processing capacity. In Indonesia, the possible incentives included (Bellefleur 2014):

- 0% import duty on imports of capital goods
- 0% import duty on imports of goods and materials required for processing
- An Investment Tax Allowance in the form of a taxable income reduction of as much as 30% of the realized investment, spread over 6 years
- An exemption from corporate income tax for 5 to 10 years beginning from the date commercial production commences (corporate income tax measures apply only to investments over US$ 100 million)
- A 2-year 50% reduction in corporate income tax liability after the end of the tax holiday period
- An extension of the exemption or reduction in corporate income tax depending on the competitiveness and strategic value of the industry

The prospect of generous tax incentives spurred the interest of many investors, particularly from China. Although few projects materialized, the cost was still considerable, mainly because the tax revenues that the government had previously collected from exporting mining companies disappeared. The cost in terms of lower tax revenues may have been behind the decision in early 2016 to end the export restrictions as of the beginning of 2017 (Mining.com 2016).

But according to some observers, a second theory is possible (Inside Indonesia 2017). Prior to the ban, state-owned company PT Aneka Tambang (Antam) exported the largest proportion of Indonesia's nickel concentrates. This meant that Antam suffered huge financial losses when the nickel ban was introduced. In 2014, the consensus among policy makers was that Antam would have to suffer immediate financial pain in order to eventually become a driver of value-added economic growth. Unable to export, and with no domestic smelter to sell to, Antam's profits fell precipitously. In 2015, the government poured about half a billion US dollars into Antam in order to boost the company's output and help it invest in several downstream projects. It has been suggested that the government's decision to relax the ban was more about fixing Antam's bottom line than about fixing broader budget troubles. Indeed, in the lead up to the January 2017 smelter deadline, there were rumors that the ban would be relaxed for Antam only and not for Indonesia's hundreds of smaller domestic nickel exporters. When the relaxation was announced, Antam's shares jumped 6%.

Additional costs may be associated with trade measures. In order to protect the new processing industry from import competition, various kinds of trade measures are usually introduced, which result in higher input costs for domestic manufacturing. Moreover, once a processing plant has been built, it has to be kept operating at capacity, even if mine production declines. The result is excess capacity, squeezed margins and, usually, need for state financial support.

Benefits

One of the most frequently cited benefits of downstream processing is an increase in value added. Increased value added is often presented as a self-evident argument in favor of measures to promote further processing. The underlying reasoning is not clear. While value is always added in the simple arithmetic sense that the price of the processed product is

(normally) higher than that of the unprocessed one, it is of course possible for the value added through processing to be negative, for instance, if the processing costs exceed the increase in price. This is possible particularly in situations where mining companies have been obliged by legislation to carry out processing.

Increased export revenue is another potential benefit, which may be important if the economy of the host country is facing balance of payments constraints. This may, however, be offset by reduced export revenues from unprocessed minerals, if export restrictions are at the heart of the policies pursued, as in the Indonesian case.

It is sometimes argued that downstream processing will result in higher fiscal revenue. However, if a company has to be forced to undertake an investment, this implies that the investment is not a very profitable one. Accordingly, obliging it to invest is unlikely to result in significant additional fiscal income.[3] Other tax revenues such as income tax paid by employees and VAT are also likely to yield only insignificant amounts since downstream processing of minerals is almost always capital intensive, which means that wages are a small portion of the value added, and since VAT is normally reimbursed to exporters—and the bulk of the processed production is likely to be exported. Again, if the policy results in reduced exports of unprocessed minerals, all the different kinds of fiscal revenues from mining will fall, often by much more than the tax revenues generated by increased processing.

If on the other hand there are monopoly rents in processing, it would be reasonable for the government to use fiscal policy to try to correct the situation in order both to raise economic efficiency and also to increase government income from the extractive sector. As seen from the discussion of processing margins, the existence of large monopoly rents in mineral processing is however far from certain.

Prospects of increased employment have also been cited to support the argument for downstream processing. However, as already argued, downstream processing is usually very capital intensive so any addition to employment is modest, unless, of course, the processed product is an important input into labor intensive activities, which might become more competitive as a result of improved availability of the processed product. This is a possible long-term advantage, but the loss of employment in the short and medium term from constraining exports of unprocessed products will often be considerably larger. Moreover, while some jobs in mineral processing are general in scope and may entail portable skills, some are not and many of the skills cannot be used in other industries.

[3] The investment could for instance show a book profit but might not achieve the hurdle rate of return applied by the company, which in principle means that the company has other better investment opportunities. In any case, this implies that profits are relatively low, as would be expected tax revenues.

Industrial diversification, aiming to increase the resiliency of the economy to shocks as well as its long term growth potential, is another often cited argument for downstream processing. Incentives to create and support downstream industries could be justified if they made the economy, including exports, more diverse and therefore more resistant to adverse events. Moreover, increased diversification may lead to a denser network of inter-industry links, thereby creating additional opportunities for growth. The skills used in downstream industries may allow incomes to rise and stimulate the economy, particularly at the local/regional level—but this is exactly what mining does in any case. Nevertheless, if skills are indeed portable, learning effects may be significant and may extend beyond the mining sector.

Conclusions

In conclusion, it should first be noted that there are few if any examples of successful use of taxes or restrictions on unprocessed products to promote downstream processing.[4] Existing empirical evidence such as the Indonesian experience or the experience of export taxes on iron ore in India[5] shows that the initiatives that have been taken do not appear to be based on a careful assessment of costs and benefits. In particular, the severity and duration of the downturn in exports of unprocessed products appear to have surprised governments in both countries. In other countries, where outright export bans have not been used and where export taxes have been smaller as a portion of the sales price, the consequences have been less severe and less directly observable. This is the case in particular, where closures of capacity have been avoided, the consequences mainly take the form of lost potential production, which is less obviously attributable to the policy.

A successful policy would have to at least offset the negative impact on national income, employment, and tax revenue from reduced mining activity with positive impacts from increased processing. However, it seems that few governments even attempt to estimate either the negative or the positive impacts in any systematic manner.

[4] It could be argued that China's restrictions on exports of rare earth metals constitutes a successful example. However, China did lose a dispute in the WTO over its export restrictions (World Trade Organization, DS433) and, as pointed out by Humphreys (2017), the restrictions did not in any case impose any economic cost since the quotas imposed by China were not used up by western buyers.

[5] The Indian steel industry uses mainly lump iron ore and high grade fines. In order to assure the steel industry of secure raw materials supply, a 5% export tax on iron ore lumps and fines was introduced in 2009 and raised in stages to 30% in 2011. Royalties on iron ore were raised from 10 to 15% in 2014. As a result, from being the world's third largest iron ore exporter in 2011, India became a net importer of iron ore in 2014. Although exports have recovered somewhat since then, they are still dramatically lower than they were before the taxes were introduced (Östensson and Löf 2017).

It is probably reasonable to point out that the presence of raw material resources constitutes only one of the factors that need to be taken into account when taking a decision on the location of a particular type of plant. Incentives or directives to promote downstream processing thus represent only one variation on the familiar theme of picking winners—and one based on a particularly narrow set of criteria. It would probably be more productive in most cases to instead emphasize industrial policies that focus on removing constraints and bottlenecks that stand in the way of the economy reaching its full potential, including those relating to skills, credit, energy supply, transport infrastructure, and inappropriate regulation. Where foreign processors are suspected of exploiting superior market power or practicing transfer mispricing, strengthened regulation is the answer, rather than forced vertical integration.

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